United States Patent

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[54] **INK SYSTEM FOR PRINTING MACHINES**
8 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **101/350,** 101/366, 222/64, 137/386
[51] **Int. Cl.** **B41f 31/06**
[50] **Field of Search** 101/366, 363, 350, 364–365, 367; 137/386, 571, 574, 576, 2, 12, 14, 78, 101.25, 102; 222/64, 581, 578; 15/257.072

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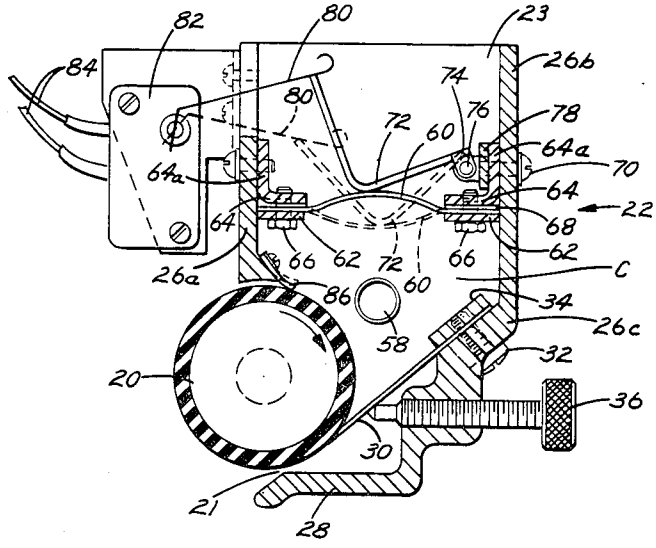
ABSTRACT: An ink system is provided wherein ink is pumped from a container to an enclosed ink fountain, thereby eliminating exposure of the ink to the atmosphere. A flexible diaphragm constitutes a cover for the ink fountain. In its retracted and distended positions the diaphragm, by electrical means, controls the starting and stopping of the pump to assure an adequate supply of ink in the fountain and automatic replenishing of the ink used.



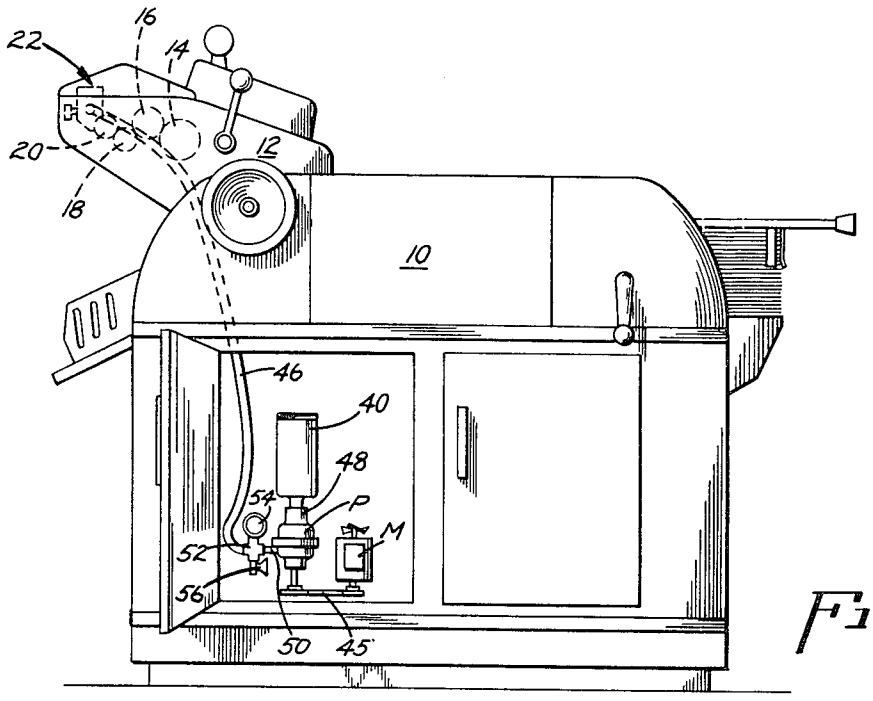


Fig. 1

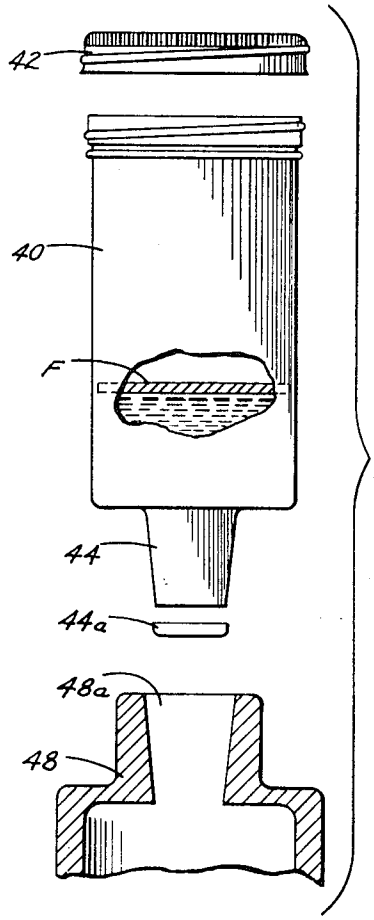


Fig. 4

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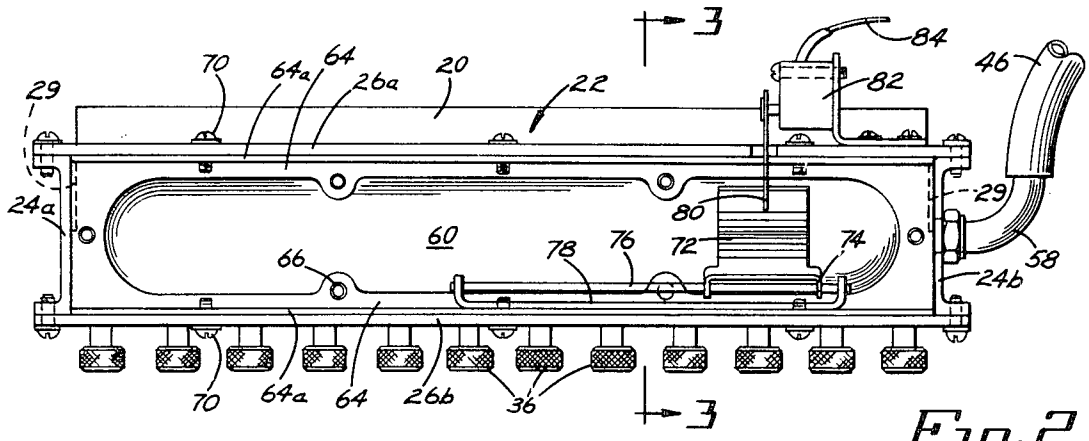

Fig. 2

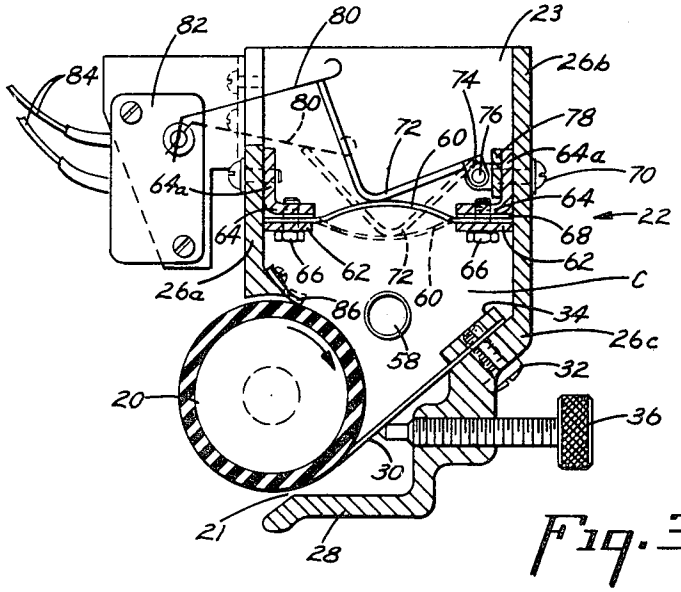

Fig. 3

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INK SYSTEM FOR PRINTING MACHINES

This invention relates to printing machines and, more particularly, to an ink system for use in printing machines.

Conventional ink systems usually comprise a fountain which contains the ink, and a roller which rotates in the fountain, picking up ink and feeding it to additional rollers and eventually to the printing form which may be in the nature of a planographic plate or master, or raised-type characters. Generally, the ink fountain also includes an adjustable doctor blade which is spaced from the fountain roller a predetermined distance so as to control the amount of ink picked up by the roller.

Such ink systems have been in use for many years and perform satisfactorily to the extent of their limitations. For example, one disadvantage has been the fact that the ink fountain is exposed to the atmosphere and becomes a target for foreign matter such as dust, dirt, paper lint, and the like, all of which may be fed with the ink onto the finished printed copy, thereby adversely affecting the quality of the print. In addition, ink laying in an exposed ink fountain for too long a time tends to have a skin formed thereon. To avoid this condition, it is necessary to clean the fountain of aging ink at frequent intervals, a time-consuming chore.

Another disadvantage of conventional ink systems is that the ink supply in the fountain must be replenished from time to time in the course of normal operation of the printing machine and the usual practice is for the operator to perform this duty manually with the aid of a spatula, putty knife, or the like, being careful to apply the ink uniformly along the fountain roller and to avoid getting any of the ink on other parts of the machine and thus creating an untidy operating condition.

The present invention has as its primary object the provision of an ink system which can be permitted to stand for long intervals between uses without ink deterioration, and in which the ink is continually protected from contamination by foreign matter or foreign by air contact.

This object is achieved according to the present invention by providing an enclosed ink supply system for a printing machine in which the ink remains completely concealed and unexposed to the atmosphere, and thus free from possible oxidation, from the time it is housed in the original container until it is transferred from the ink fountain roller to other rollers in the ink train.

Another object of the invention is to provide for automatic replenishment of the ink in the ink fountain to thereby insure an adequate working level of ink in the fountain regardless of the amount being used in the printing operation, and, at the same time, avoid the disadvantages and messiness generally associated with manually adding ink to the ink fountain, and to simplify the introduction of a new ink supply when necessary. Other and further objects, features and advantages of the present invention will be apparent as the description proceeds.

IN THE DRAWINGS:

FIG. **1** is a front elevation of a printing machine having an ink supply system embodying the features of the present invention;

FIG. **2** is a plan of an ink fountain incorporated in the printing machine illustrated in FIG. **1**;

FIG. **3** is a section, on an enlarged scale, taken on the line 3—3 of FIG. **2**; and

FIG. **4** is an exploded elevational detail on an enlarged scale, showing an ink container utilized in the ink supply system, with a portion of the container broken away, and showing the same in relation to a pump inlet.

In FIG. **1** there is shown a printing or duplicating machine, indicated generally by the reference numeral **10**, in which the inking system of the present invention may be utilized. It should be understood, however, that the concept described and claimed herein may be applied to a variety of printing and duplicating machines and, in fact, to any apparatus where the use and automatic feeding of inklike materials is desired.

The printing machine **10** has mounted thereon an ink unit, indicated generally at **12**, which includes one or more ink transfer rollers such as, for example, rollers **14**, **16** and **18**, which are effective to transfer ink from an ink fountain roller **20** to a printing plate or form (not shown). As shown in FIG. **3**, fountain roller **20** is rotatably mounted in an ink fountain **22**.

Ink fountain **22** may be of one-piece construction, e.g., a casting, or it may be an assembly of individual parts. It is deemed sufficient for an understanding of the invention to merely state that, as shown in FIGS. **2** and **3**, fountain **22** comprises a pair of sidewalls **24***a* and **24***b*, a front wall **26***a*, a rear wall **26***b* and an ink chamber C. As shown in FIG. **3**, the rear wall **26***b* may conveniently be extended so as to provide a base **28** for ink fountain **22**. To prevent leakage of ink from fountain **22**, wiper pads **29**, FIG. **2**, are provided at each end of fountain roller **20**, i.e. between the ends of the fountain roller and sidewalls **24***a* and **24***b* of fountain **22**. Wiper pads **29** preferably should be of a porous, resilient material such as, for example, felt.

In a preferred form of the invention, as seen in FIG. **3**, fountain **22** is depicted as having a pair of openings, shown by the reference numerals **21** and **23**. Opening **21** accommodates fountain roller **20**. The purpose of the other opening **23** will become apparent as the description proceeds.

The thickness of the film of ink picked up by the fountain roller **20** is controlled by means of a doctor blade **30** which may be mounted, by way of example, on an inclined portion **26***c* or rear wall **26***b*, as shown in FIG. **3**, and retained by screws **32** threadingly engaging a backup plate **34**. A series of spaced-apart thumbscrews **36**, FIGS. **2** and **3**, are provided to enable the operator to position doctor blade **30** toward or away from fountain roller **20** to thereby regulate the amount of ink picked up by fountain roller **20**.

In FIG. **4** there is shown a preferred form of ink source comprising an ink container **40** having at one end a complementary cover **42** of the screw-on type. The other end of container **40** is provided with a neck **44** which serves as a spout. The neck **44** includes as an integral portion thereof a closed tip **44***a*. For the purpose of the description which will follow concerning the functional advantages of the ink source, the parts thereof, referred to immediately hereinabove, are shown in FIG. **4** as having been separated. It is to be understood that for purposes of shipping, storage, etc., or at a time prior to use in the printing machine, cover **42** is fastened to container **40** and tip **44***a* is an integral portion of neck **44** of container **40**. The container **40** is made of a suitable semirigid plastic material so that the tip **44***a* can be readily removed by cutting with a knife. To this end a line of weakening is preferably appropriately located about the neck **44** to assist in this operation.

Under certain conditions, as will be explained more fully hereinafter, it may be advantageous to employ a follower F to cause the ink to be withdrawn from container **40** in a uniform manner.

With reference to FIG. **1**, a pump P, driven intermittently by a motor M and connecting belt **45**, is provided as a source of power means for the purpose of feeding ink from container **40** to ink fountain **22** through an interconnecting tube or passageway **46**. Pump P may be a conventional screw-type pump since a pump of this nature has been found to perform satisfactorily.

An inlet **48** is provided on pump P to receive ink from the ink source or, more specifically, from container **40** by way of neck or spout **44**. As shown in detail in FIG. **4**, neck **44** is designed to fit snugly in an opening **48***a* of pump inlet **48**.

Referring again to FIG. **1**, pump P is provided with an outlet **50** through which the ink is conveyed through a hollow coupling **52** and into passageway **46**. For operator convenience, coupling **52** may include a gauge **54** which affords a ready checkpoint to indicate malfunction of the pump or the motor, or depletion of the ink supply, or the like. Coupling **52** may also include a conventional petcock **56** which is useful in checking the flow of ink, draining of the pump, etc. Passageway **46** terminates in an inlet **58**, FIGS. **2** and **3**, through which the ink reaches ink fountain **22**.

As stated hereinabove, ink fountain **22** has a pair of openings, **21** and **23**, opening **21** accommodating fountain roller **20**. With reference to FIGS. **2** and **3**, within and closing the opening **23** there is positioned a flexible diaphragm **60**. Diaphragm **60** is preferably of such dimension as to constitute a cover for ink fountain **22**, thereby protecting the surface of the ink in the fountain against contamination by foreign matter and oxidation by air contact. Thus, it will be readily seen that positioning of diaphragm **60** in opening **23**, and placement of ink fountain roller **20** in opening **21**, affords a substantially closed structure for ink fountain **22**.

Diaphragm **60** may be of any suitable, thin flexible material which is not subject to deterioration due to contact with the ink in chamber C. It has been found that a plastic material, such as polyethylene, for example, performs entirely satisfactory for this purpose.

Diaphragm **60** is assembled to ink fountain **22** in a somewhat loose or slack manner, i.e. not taut, so that it may assume what might be termed two positions, e.g., an outer or distended position, as indicated by full lines in FIG. **3**, and an inner or retracted position as indicated by broken lines. Diaphragm **60** is mounted between a pair of frame members **62** and **64** and may be fastened thereto, for example, by screws **66** threadingly engaging frame **64**. To prevent possible leakage of ink at this point, a gasket **68** of substantially the same dimensions as lower frame member **62** may be placed between diaphragm **60** and one of the frame members **62** or **64**. For ease and convenience of retaining diaphragm **60** on ink fountain **22**, upper frame member **64**, as viewed in FIGS. **2** and **3**, may include angular portions **64***a* which are fastened to ink fountain **22**, for example, by screws **70**.

As shown in FIGS. **2** and **3**, a sensing plate **72** is in surface contact with an exposed portion of diaphragm **60** and is movable therewith. Sensing plate **72** may be formed so as to include ears **74** which are perforated to permit the sensing plate to be pivotally mounted on a pin **76** which in turn is held by a bracket **78** mounted on ink fountain **22**.

Riding on sensing plate **72** is a sensing finger **80** of a control switch **82**. Switch **82** is connected by an electric circuit **84** to motor M which is energized when the sensing finger **80** is in approximately the broken line position shown in FIG. **3**.

Sensing plate **72** is shown in FIG. **2** as being of such size that it contacts, or rests on, only a small portion of the exposed surface of diaphragm **60**. Such illustration is by way of example only, since it is recognized that under certain conditions, e.g. when a low-viscosity ink is employed, it may be desirable to have more extensive surface contact between the sensing plate **72** and the exposed portion of diaphragm **60**. With a small area of contact and low-viscosity ink it has been found that, even with very light spring loading of the arm **80**, it is possible for the latter to depress the diaphragm locally so as to give erroneous or erratic level indications. With greater surface contact, there is less likelihood of the plate **72** depressing only a local portion of the surface of the diaphragm while the general level remains higher, and the resulting tendency to overfill the fountain with consequent chance for ink leakage at the diaphragm connections is avoided. It follows that when an extremely high-viscosity ink is employed, even sensing plate **72** may be dispensed with, and sensing finger **80** may be arranged to make direct contact with diaphragm **60**. The viscosity of the ink employed is controlling in this respect, and the contact area is so adjusted that the sensing finger **80** will move reliably in unison with the general level of diaphragm **60**. It is, therefore, considered within the purview of the invention that if a member such as sensing plate **72** is utilized, it should be of a surface dimension which, considering the degree of loading applied by the sensing means, is capable of reliably following the breathing motion of the diaphragm **60** which, as shown in FIG. **3**, is between the distended position shown in solid lines and the retracted position shown in broken lines.

It is also considered within the scope of the invention that sensing plate **72**, if included, may be a part of, or affixed to, sensing finger **80** rather than as shown in FIGS. **2** and **3**.

Also shown in FIG. **3** is a strip **86** of flexible material which may be fastened to the inside of front wall **26***a* of ink fountain **22** in the manner shown. Strip **86** extends over a portion of the periphery of ink fountain roller **20**, thus bridging the clearance gap between the lower edge of wall **26***a* of ink fountain **22** and roller **20**. Strip **86** preferably is of a length at least equal to the length of ink fountain roller **20**, thereby providing a seal to prevent possible leakage of ink, particularly ink of low viscosity, at this point, and thus further insuring a closed ink fountain structure. Since sealing strip **86** is flexible, it permits free rotation of ink fountain roller **20** even in an instance when foreign matter may be backed onto the fountain roller from the other ink rollers, **14**, **16**, **18**. Such an incident causes temporary flexing of sealing strip **86** to the broken line position shown. The direction of slope of the strip is, however, such that the pressure of the ink, which is maintained at a height substantially above the level of the strip, tends to tighten the grip on the roller and insure sealing action. Material such as, for example, polyethylene terephthalate, sold under the trademark "Mylar," has been found to function satisfactorily for the strip **86** due to its flexibility and toughness, and its quality of being resistant to chemical reaction with inks.

To summarize the operation of the ink system described in detail hereinabove, it is deemed advisable first to assume that the ink system is devoid of ink, as would occur in the case of a newly installed printing machine, a change in ink colors, etc. Starting in this manner, tip **44***a* is severed or otherwise removed from neck **44** of container **40** and the container is inverted to the position shown in FIG. **4**. Neck **44** is inserted into opening **48***a* of pump inlet **48** with a snug friction fit. Cover **42** may be removed from container **40**, although it has been found that merely loosening the cover is sufficient to relieve any vacuum and permit the ink to be withdrawn from the container and, at the same time, prevent foreign matter from falling into the ink.

At this point, it should be mentioned that since chamber C of ink fountain **22** contains no ink, diaphragm **60**, sensing plate **72** and sensing finger **80** are in the retracted or broken line positions shown in FIG. **3**.

Motor M is switched on to actuate pump P, thereby drawing ink from container **40**. As the pumping action continues, ink is fed through passageway **46** and inlet **58**, into ink chamber C of ink fountain **22**. As the level of ink pumped into chamber C rises due to the continued running of pump P, it reaches diaphragm **60** which, it must be remembered is in the broken like position shown in FIG. **3**, and gradually forces it upwardly. Sensing plate **72** which is resting on diaphragm **60**, and sensing finger **80** which is resting on sensing plate **72**, naturally follow the upward, or outer movement of diaphragm **60**. Such movement continues until diaphragm **60**, sensing plate **72** and sensing finger **80** reach the distended full line positions shown in FIG. **3**. At this point, ink chamber C is filled with ink and a important aspect of the arrangement disclosed is realized, i.e., sensing finger **80** reaches its "off" position, thereby opening switch **82** and discontinuing power through circuit **84**, shutting off motor M. With the stopping of the motor, the action of pump P is arrested, thus discontinuing supplying of ink to ink fountain **22**.

Mention has been made of the objective of providing ink closed ink fountain. This feature should not be confused with what might be termed an "airtight" fountain. An airtight fountain is neither necessary nor desirable to practice the novel aspects disclosed herein due to the inherent problems created thereby, not the least of which would be considerable additional cost. For example, if ink fountain **22** were tightly sealed against escape of air, some means would be required to exhaust the air from the fountain following the start of the flow of ink through passageway **46**. If this were not done, air would be pushed into fountain **22** ahead of the ink causing premature flexing of diaphragm **60** to its distended position, with the result that pump P would be shut off prior to complete filling of the fountain.

The above-mentioned condition is avoided, at least until such time as the ink reaches a level approximately equal to the position of ink-sealing strip **86**, FIG. **3**, by felt wiper pads **29** which because of their resiliency permit ink fountain roller **20** to rotate and, because of their porous nature also serve to permit escape of air between the ends of roller **20** and sidewalls **24***a* and **24***b* of fountain **22**.

Assuming that ink has been pumped into fountain **22** and has reached the level of ink sealing strip **86**, the aforesaid provision for air escapement is, of course, no longer effective. However, this factor was considered in the design of the diaphragm-retaining means and it will be noted that frame members **62** and **64**, diaphragm **60** and gasket **68** are assembled in a manner so as to be positively held together by screws **66** but that the spacing between the screws is such that air may be permitted to escape without leakage of ink, even ink of low viscosity. When the fountain is full, all these minute air leakage passages are sealed off by the ink so that virtually no oxygen is allowed to come in contact with the ink anywhere within the ink system.

It should be understood that operation of the printing machine, i.e., the running of copies therefrom, need not wait until ink chamber C is completely filled. The printing operation may be started when the ink in the chamber is at a level sufficient to provide a film of ink on the periphery of ink fountain roller **20** as the roller is normally rotated.

During the time the printing machine is operating and ink is being consumed in the printing of copies, the supply of ink in chamber C, of course, gradually decreases to the point where replenishment is desirable. Unlike conventional ink systems wherein adding ink to the fountain is effected manually, the novel arrangement disclosed provides automatic replenishment of the ink. For example, diaphragm **60**, which is in contact with the upper level of ink ink supply may be described as resting thereon, follows the ink level as the ink is gradually withdrawn from chamber C. Such movement of diaphragm **60** continues until it reaches substantially the broken line position shown in FIG. **3**. Sensing finger **80** (and sensing plate **72**, when used) follow movement of diaphragm **60**, to positions also indicated by the broken lines. In this position, sensing finger **80** causes the closing of switch **82** to restore power to motor M through circuit **84**, thus actuating pump P to start the cycle to again fill chamber C with ink.

It is of particular importance to note that since diaphragm **60** is in contact with, and completely covers, the upper level of the ink during normal operation of the printing machine, there is no possibility of the surface of the ink in fountain **22** being subject to attack by oxygen as the diaphragm moves between its retracted and distended positions.

From the above explanation, it will readily be seen that movement of diaphragm **60** and sensing finger **80** between their retracted and distended positions control the starting and stopping of pump P to thereby maintain a substantially predetermined operating level of ink in fountain **22**. This level is substantially greater than that maintained in the usual ink fountain, so that the possibility for leakage over the top of the fountain roller exists. This leakage, as explained above is prevented by the action of strip **86**. The high level of ink in the fountain, moreover, provides a positive hydraulic head at the gap which is sealed by the strip **86**, and thus discourages the introduction of the moistening fluid into the ink fountain by way of the surface of the fountain roller **20**.

As mentioned hereinabove, it may be desirable under certain conditions to provide a follower F, FIG. **4**, to assist in the uniform withdrawal of ink from container **40**. Such conditions may exist when stiff, pasty, or high-viscosity inks are employed. Normally, gravity beeps pump P primed. However, when the ink in the container is nearly exhausted, or at the approximate ink level shown in FIG. **4**, gravity alone may not level the bigh-viscosity high-viscosity supply rapidly enough because of its stiff consistency. If this condition occurs, the pump pulls its ink from the center of the supply rapidly enough to form an air passage through to the surface. Pump P then sucks air and the ink flow stops well before container **40** is anywhere near empty. By using follower F, which it will be noted is of a dimension slightly less than the internal dimension of container **40**, the suction created by pump P causes the ink body to move down uniformly and to prevent the formation of a central air passage so that practically all of the ink can be exhausted from container **40** by the pumping action.

When the ink supply is exhausted, i.e., the container **40** has been emptied (as indicated to the operator by a drop in pressure on gauge **54**) it is a simple matter for the operator to remove the container **40** and discard it, replacing it with a new container **40** from which the tip **44***a* has been cut and whose cover **42** is then loosened. The whole operation can be performed in an instant with virtually no mess, and is required only at very infrequent intervals.

Because of the enclosed nature of the system, the ink can be allowed to stand in the machine indefinitely with no need ever to clean the fountain unless a change of ink color is desired.

While preferred embodiments of the invention have been described and illustrated, it is to be understood that these are capable of variation and modification. Accordingly, the aim in the appended claims is to cover all such variations and modifications as may fall within the true spirit of the invention.

We claim:

1. An enclosed ink supply system for a printing machine in which the ink is protected from exposure to the atmosphere, comprising:

an ink fountain mounted on the printing machine, said ink fountain having a pair of openings therein;

an ink fountain roller rotatably mounted in one of said openings in said ink fountain in air-excluding relationship therewith;

a flexible diaphragm associated with the ink fountain so as to close the other opening in the fountain to thereby provide a substantially enclosed ink fountain structure in which the ink in the fountain is in contact with the walls of the fountain, the roller and the diaphragm and air is excluded from the fountain interior, said diaphragm adapted to flex between a retracted position and a distended position in relation to said fountain;

a sensing finger coacting with the exterior of said diaphragm and movable thereby between said retracted and distended positions;

an air-excluding source of ink supply;

power means for feeding the ink from the supply source to the ink fountain; and

switching means controlled by the sensing finger for activating said power means when the diaphragm is in the retracted position to thereby supply ink from the supply source to the fountain, and for deactivating the power means to thereby discontinue the supplying of ink to the fountain when the diaphragm is in the distended position.

2. An ink system according to claim **1**, in which a sensing plate rests freely on said diaphragm in interposition between said diaphragm and said sensing finger and is movable with the diaphragm between said retracted and distended positions.

3. An ink system according to claim **1**, in which said power means comprises an intermittently driven pump having an inlet for receiving ink from said supply source and an outlet connected with said fountain.

4. An ink system according to claim **1**, in which said supply source comprises a container which includes a follower to assist in uniform withdrawal of the ink from the container under the effects of atmospheric pressure.

5. An ink system according to claim **1**, in which an elongated flexible strip extends from said ink fountain to a portion of the periphery of said ink fountain roller so as to form a seal therebetween.

6. An enclosed ink supply system for a printing machine in which the ink is protected from exposure to the atmosphere, comprising:

an ink fountain mounted on the printing machine, said ink fountain having a pair of openings therein;

an ink fountain roller rotatably mounted in one of said openings in said ink fountain in air-excluding relationship therewith;

a flexible diaphragm associated with the ink fountain so as to close the other opening in the fountain to thereby provide a substantially enclosed ink fountain structure in which the ink in the fountain is in contact with the walls of the fountain, the roller and the diaphragm and air is excluded from the fountain interior, said diaphragm adapted to flex between a retracted position and a distended position in relation to said fountain;

a sensing finger coacting with the exterior of said diaphragm and movable thereby between said retracted and distended positions;

an air-excluding source of ink supply;

power means for feeding the ink from the supply source to the ink fountain; and

switching means controlled by the sensing finger for activating said power means when the diaphragm is in the retracted position to thereby supply ink from the supply source to the fountain, and for deactivating the power means to thereby discontinue the supplying of ink to the fountain when the diaphragm is in the distended position, the retracted position of the diaphragm being at a level such that the ink in said fountain will be well above the top of the fountain roller to thereby maintain a significant head of ink pressure to discourage moisture entrained by the fountain roller from entering the fountain.

7. An enclosed ink supply system for a printing machine comprising:

pumping means including an inlet fitting:

a container filled with printing ink, said container having a neck compatible with said fitting for ready connection thereto with a mating sealing fit, and ready disconnection therefrom, said container having the end opposite said neck closed by a removable cover to permit filling and allow air access during emptying;

an ink fountain mounted on the printing machine and connected to the pumping means by a passageway, said ink fountain having a pair of openings therein;

an ink fountain roller rotatably mounted in one of said openings in said ink fountain;

means to seal any gap between the roller and the fountain;

a flexible diaphragm associated with the ink fountain so as to close the other opening in the fountain to thereby provide a substantially enclosed ink fountain structure whereby the surface of the ink is protected by the diaphragm against possible oxidation, said diaphragm adapted to flex between a retracted position and a distended position in relation to said fountain;

a sensing finger superimposed on said diaphragm and movable therewith between said retracted and distended positions;

means to activate said pumping means for feeding the ink from the container through the passageway to the ink fountain; and

switching means controlled by the sensing finger for activating said power means when the diaphragm is in the retracted position to thereby supply ink from the container to the fountain, and for arresting the power means to thereby discontinue the supplying of ink to the fountain when the diaphragm is in the distended position.

8. An enclosed ink supply system as set forth in claim 7 in which said container includes a follower to assist in uniform withdrawal of the ink from the container.

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